INDUSTRIAL PRODUCTS DIVISION (ITT) MODEL NO. 2135-D

(See Schematics Nos. 23-36A and 23-36B)

CATHODE-RAY TUBE: *Type* — 21ECP7; Accelerating Poten-

SWEEP SYSTEM: Magnetic

VERTICAL AMPLIFIER
Parallel Yoke Switch Position — Main Input: continuously variable from 20 mv to 200 volts p-p/inch. Auxiliary Input: approximately constant at 12 volts p-p/
Series Yoke Switch Position — Main Input: continuously variable from 10 mv to 100 volts p-p/inch. Auxiliary Input: approximately constant at 6 volts p-p/inch.
Rise Time (< 1.6" deflection centered vertically): *Parallel connection of yoke* — 1.5 ± 0.15 microsec; *Series connection of yoke* — 2.3 ± 0.25 microsec.
Rise Time (< 1.6" deflection centered vertically): *Parallel connection of yoke* — none. *Series connection of yoke* —

Frequency Response (Within limits set by maximum unlimited deflection characteristics): *Parallel connection* — down 1 db at 180 kc ±10%; down 3 db at 270 ±10%. *Series connection of yoke* — down 0.1 db at ±10%; down 1 db at 130 kc ±10%; down 3 db kc ±10%.
Frequency Response: D-c Input — uniform to d-c. A-c — down 3 db at 1.6 cps.

HORIZONTAL AMPLIFIER
Rise Time: 3.5 ± 0.35 microsecond (< 1.17" deflection horizontally).
Overshoot: Less than 10%.
Frequency Response (Within limits set by maximum unlimited deflection characteristics): Down 0.1 db at ±10%; down 1 db at 135 kc ±10%; down 3 db kc ±10%.
Frequency Response: D-c Input — uniform to d-c. A-c — down 3 db at 1.6 cps.

SWEEP CIRCUIT
Range: Continuously variable in 4 decade ranges from 10 microsec/inch to 1 sec/inch.
Calibration Accuracy: +1 −6% on 0.1 to 1 second/inch ±5% on 10 to 100 microsec/inch range; ±2% on ranges.

Trigger Sensitivity — Approximately −20 volts required to Input Impedance: 250X shunted by approximately 45

POWER SUPPLY: Separate low voltage rack-mounted supply with 4 ft power cable.

POWER REQUIREMENTS: 105 – 125 volts single phase, 50 – watts maximum.

JACKSON MODEL CRO-2

(See Schematics Nos. 23-37A through 23-37E)

FREQUENCY RESPONSE
— *Amplifier set for wideband operation:* Sine-wave uniform within 10% from 20 cycles to 4.5 mega-
Amplifier set for high sensitivity: Sine-wave re- uniform within 10% to 100 kc., down not more at 200 kc., down not more than 50% at 300 kc.
amplifier: Sine-wave response uniform within 20 cycles to 100 kc., down not more than 50%

DEFLECTION FACTOR
amplifier — *High sensitivity* — 0.018 volts rms sine for 1-inch peak-to-peak deflection. *Wideband* — 0.25 volt rms sine for 1-inch peak-to-peak.
Attenuation factors of 10 and 100 available for both high sensitivity and wideband.
Horizontal Amplifier — 0.40 volt rms for 1-inch peak-to-peak deflection. Attenuation factor of 10 available.

HORIZONTAL SWEEP: Frequency range 20 cycles to 50 kilocycles.

POWER SUPPLY SOURCE: Rating — 110–120 volts, 50–60 cycle. Power consumption — 60 watts.

KNIGHT MODEL 83YZ-144

(See Schematic No. 23-38)

VERTICAL AMPLIFIER
Sensitivity: 0.025 volt (rms) per inch
Frequency Response: Flat to 2.5 mc within 1 db; to 5 mc within ±3 db.
Input Impedance: In 1 attenuator position 2.9 megohms shunted by 21 mmfd. In 0.1 and 0.01 positions 3.4 megohms shunted by 12 mmfd.

HORIZONTAL AMPLIFIER
Sensitivity: 0.6 volt (rms) per inch
Frequency Response: −3 db at 600 kc; −4 db at 1 mc

SWEEP GENERATOR
Range: 15 cycles to 600 kc
Synchronization: Internal positive; internal negative; external; line frequency

KNIGHT MODEL 83YZ-146

(See Schematic No. 23-39)

VERTICAL AMPLIFIER
Sensitivity: 0.025 volt (rms) per inch
Frequency Response: 3 db down at 700 kc (1000 cps reference)
Input Impedance: 3.3 megΩ shunted by 45 μμfd
Calibration: 1 volt p-p ±7% square wave, regulated, calibrating voltage internally injected by front panel push switch

HORIZONTAL AMPLIFIER
Sensitivity: 0.07 volt (rms) per inch
Frequency Response: 3 db down at 200 kc (1000 cps reference)

SWEEP GENERATOR: Range — 15 cycles to 150 kc in four ranges

LABORATORY FOR ELECTRONICS MODEL 411

(See Schematics Nos. 23-40A through 23-40C)

CATHODE-RAY TUBE: *Type* — 5ABP-1; P7 or P11 optional. *Accelerating Potential:* 3000 to 4000 volts; adjusted at factory to obtain vertical sensitivity of 15 mv/cm.

Y-AXIS AMPLIFIER
Deflection Sensitivity: 15 mv/cm peak-to-peak (max) for both dc and ac.
Frequency Response: dc to 10 megacycles (3 db point)

X-AXIS
Sweep Time Range — Calibrated: 0.1 μsec/cm to 0.1 sec/cm; accuracy ±5%; linearity ±5%
Frequency Response: dc to 1 megacycle (3 db point)
Internal Trigger Sensitivity: 0.5 cm of deflection for signals having slope of greater than 20 cm/sec
External Trigger Sensitivity: 1.0–100 volts for triggers having slope of greater than 40 volts/sec

Z-AXIS: Cathode of CRT a-c coupled with 0.05 μf into 47 k. A positive 15-volt pulse will blank beam for normal intensity settings

POWER REQUIREMENTS: 105–125 volts, or 210–250 volts, 50–60 cycles, 385 watts

METRIX MODEL 222*

(See Schematic No. 23-43)

CATHODE-RAY TUBE: Type: DG 10-2; diameter: 3¾" (97 mm); useful diameter: 3⅛" (80 mm); sensitivity: 43 volts peak-to-peak per inch deflection vertical (17 v/cm); 57 volts peak-to-peak per inch deflection horizontal (22.5 v/cm).

VERTICAL AMPLIFIER
Frequency response: Flat to 3 db up to 500 kc/s
Sensitivity: 70 mv per inch deflection (28 mv/cm)

HORIZONTAL AMPLIFIER
Frequency response: Flat to 3 db up to 300 kc/s
Sensitivity: 700 mv per inch deflection (280 mv/cm)

TIME BASE: Linear sawtooth — frequency 10 c/s to 50 kc/s; duration 100 ms to 20 μs.

POWER SUPPLY: Frequency: 50–60 c/s; volts: 110–130 – 220–240; power input: about 60 va.

* Compagnie Générale de Métrologie, Annecy, France.

MILLEN MODEL 90915

(See Schematic No. 23-42)

CATHODE-RAY TUBE: Accelerating voltage — 2100 volts, permits use of P1, P7, or P11 screens.

FREQUENCY RESPONSE
Vertical Amplifier or Horizontal Amplifier
D-c amplifier using either the terminals or the probe and at any gain setting: 0 to 100 kc +0 −10%; 0 to 200 kc +0 −30%; 0 to 400 kc +0 −50%. Square-wave response 0 to 10 kc
A-c amplifier using either the terminals or the probe and at any gain setting. Same as d-c amplifier except low frequency 3 db point is 0.3 cycle. Square-wave response 30 cycles to 10 kc

SENSITIVITY
Vertical Amplifier
Terminals: D-c — 0.3 volt dc per inch deflection. A-c — 0.3 volt peak-to-peak per inch deflection; 0.106 volt rms per inch deflection.
Probe: D-c — 3.0 volts dc per inch deflection. A-c — 3.0 volts peak-to-peak per inch deflection; 1.06 volts rms per inch deflection.
Horizontal Amplifier: D-c — 0.375 volt dc per inch deflection. A-c — 0.375 volt peak-to-peak per inch deflection; 0.133 volt rms per inch deflection.

SWEEP RANGE: 2 cycles per second to 30 kc per second with provisions for adding external capacity for slower sweeps

POWER REQUIREMENTS: 105 to 125 volts 50/60 cycles, or 210 to 250 volts 50/60 cycles; 105 watts power consumption

MILLEN MODEL 90923

(See Schematic No. 23-41)

CATHODE-RAY TUBE: Accelerating Voltage: 2040 volts, permits use of P1, P2, P7, or P11 screens

FREQUENCY RESPONSE
Vertical Amplifier: 7 cycles to 125 kc ± 2 db
Horizontal Amplifier: 2 cycles to 125 kc ±2 db

SENSITIVITY
Vertical Amplifier: 0.88 volt peak-to-peak per inch; 0.31 volt rms per inch deflection; 0.12 volt rms per cm deflection.
Horizontal Amplifier: 1.02 volts peak-to-peak per inch deflection; 0.36 volt rms per inch deflection; 0.14 volt rms per cm deflection.

SWEEP: Range: 2 cycles per second to 30 kc per second

POWER REQUIREMENTS: 105 to 125 volts 50/60 cycles
Size: 1 ampere

PACO MODEL S-50

(See Schematic No. 23-44)

PUSH-PULL VERTICAL AMPLIFIER
Sinusoidal Frequency Range: 5 cycles to 1.2 mc, within 6 db to 2 mc.
Sensitivity: 90 millivolts rms per inch at 1000 cycles

PUSH-PULL HORIZONTAL AMPLIFIER
Sinusoidal Frequency Response: Flat within ±3 db to 1 kc; 6 db or better at 700 kc
Sensitivity: 250 millivolts rms per inch at 1000 cycles

PACO MODEL S-55

(See Schematic No. 23-45)

VERTICAL CHANNEL (3-Stage, Push-Pull)
Sensitivity: Dc — 70 millivolts/inch. Ac — 35 millivolts rms/inch.
Frequency Response (Sine Wave): Dc — within 3 db from dc to 4.5 mc; within 5 db at 5 mc. Ac — within 3 db from 1 cps to 4.5 mc; within 5 db at 5 mc.
Rise Time: 0.08 microsecond or better.
Overshoot: 5% or less.

HORIZONTAL CHANNEL (Push-Pull Output)
Sensitivity: 0.6 volt rms/inch.
Frequency Response: Within 3 db, 1 cps to 400 kc
Frequency Range: 10 cps to 100 kc sawtooth, 7 positions. Provision for external capacitor for 1 cps.

PRECISE MODEL 300-B

(See Schematic No. 23-46)

CATHODE-RAY TUBE: Type: 7JP1/7VP1 — 7VP1 tube used in original equipment, although 7JP1 may be substituted.

VERTICAL: *Sensitivity* — 10 millivolts per inch (3.9 mv/cm), push-pull inputs. *Bandwidth* — DC to 5 megacycles (3 db).

HORIZONTAL; *Sensitivity* — 150 millivolts per inch (59 mv/cm) single-ended input.

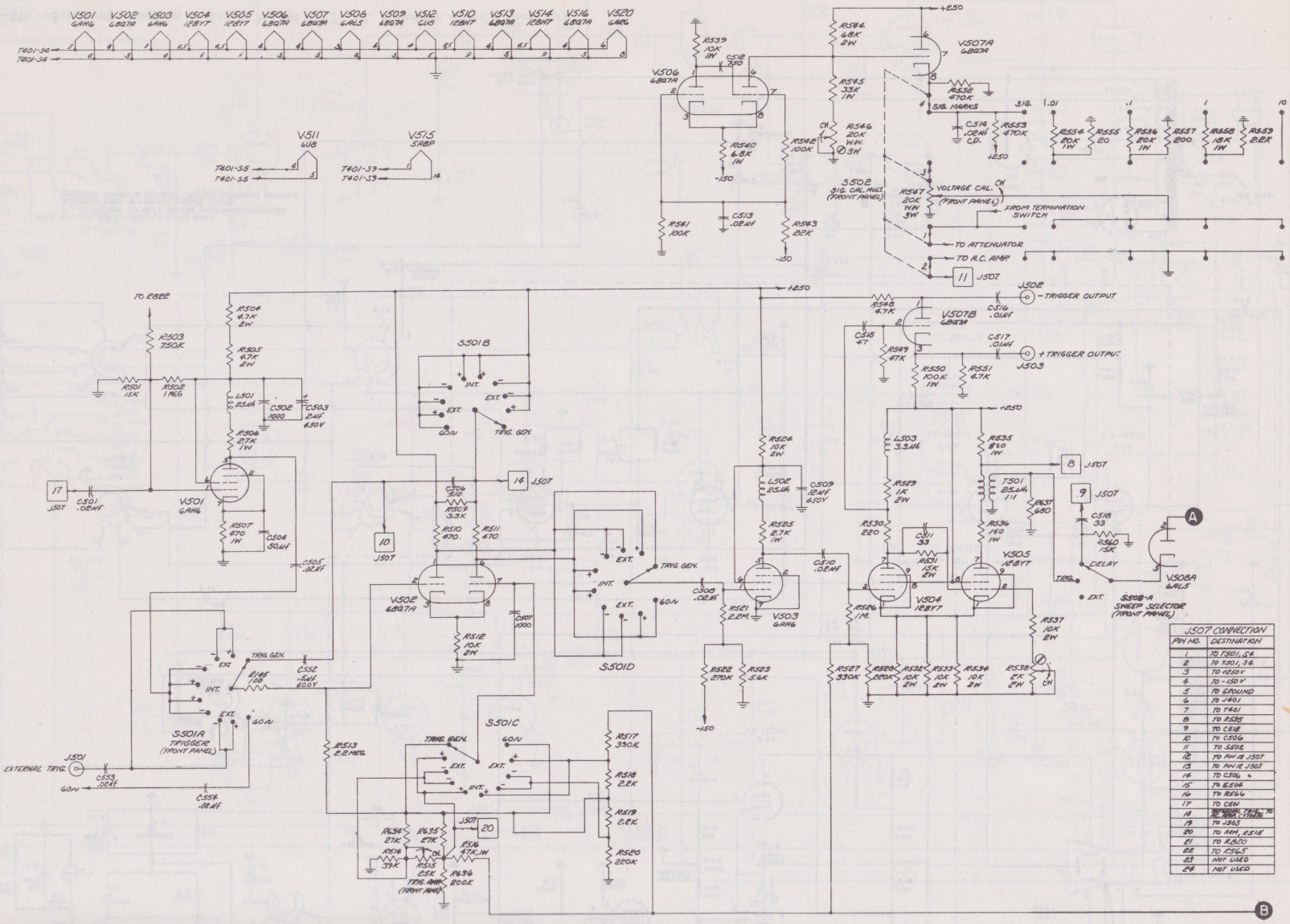
SWEEP RATE (NORMAL): *Multivibrator* — 5 tubes; *5 Position Coarse-Frequency Switch* — (external capacitor circuit); 10–100 cycles; 100–1000 cycles (internal); 1 k–10 k (internal).

PRECISE MODEL 308

(See Schematic No. 23-47)

TUBE: Type: 8CP1 — P1 phosphor, medium persistence screen normally supplied, other types available.

VERTICAL: *Sensitivity* — 10 millivolts per inch



J507 CONNECTION	
PIN NO.	DESTINATION
1	TO T501, S6
2	TO +250 V
3	TO -150 V
4	TO CHASSIS
5	TO EARTH GND
6	TO J401
7	TO T401
8	TO R585
9	TO C518
10	TO C506
11	TO S502
12	TO PNT SW J507
13	TO PNT SW J507
14	TO C506
15	TO S504
16	TO R566
17	TO C501
18	TO INTERNAL TRIG. TO INT. TRIG. CIRCUIT
19	TO J503
20	TO ANM, R515
21	TO R520
22	TO R562
23	NOT USED
24	NOT USED

Fig. 23-40A. Signal chassis of LIE Model 411. *Courtesy Laboratory for Electronics, Inc.*

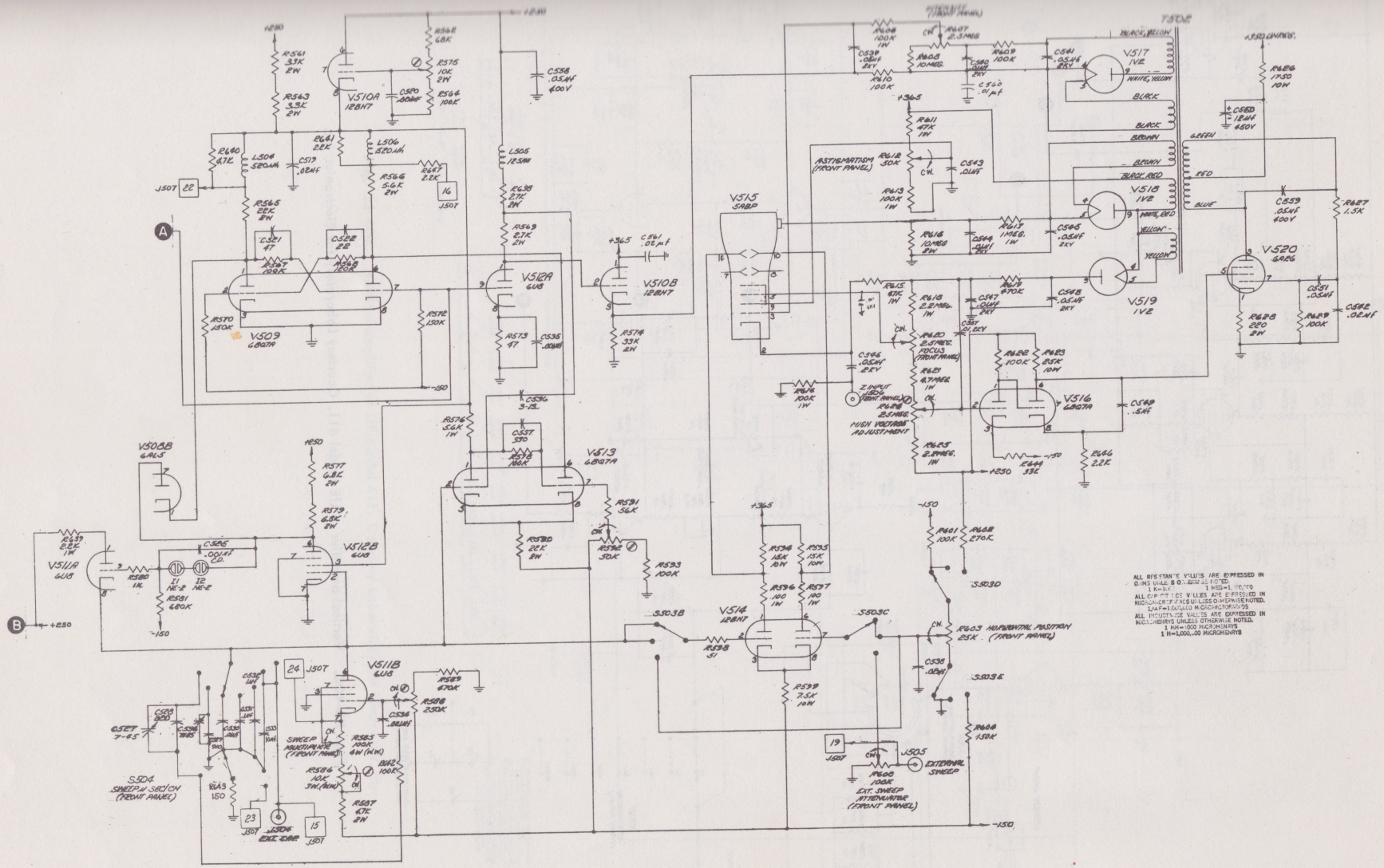
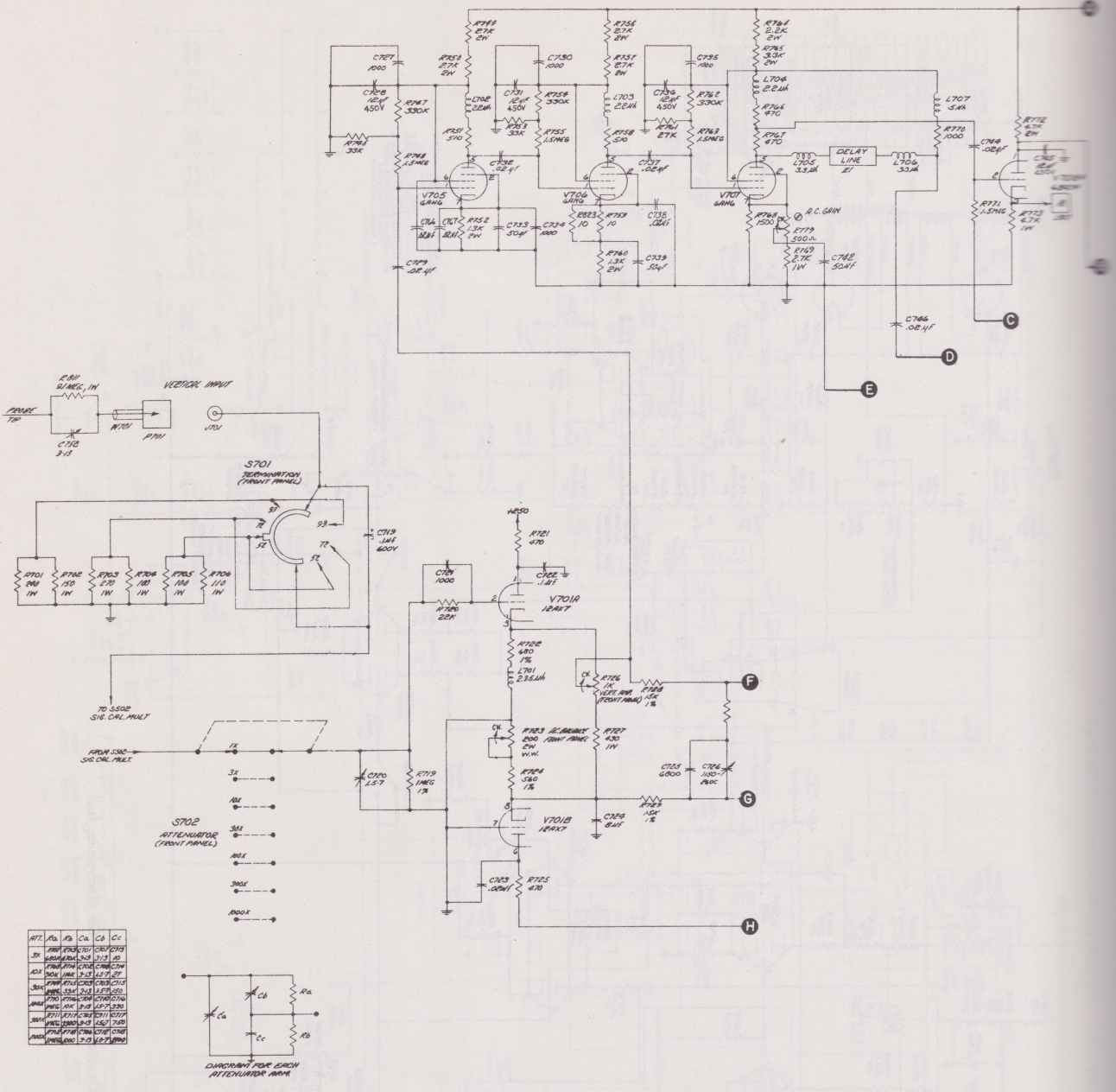


Fig. 23-40A. Signal chassis of LfE Model 411. *Courtesy Laboratory for Electronics, Inc.*



ATT.	Ra	Rb	Ca	Cb	Cc
3X	1MEG	510Ω	3-13	3-13	10
10X	510K	1MEG	3-13	1.5-7	27
30X	1MEG	33K	3-13	1.5-7	150
100X	1MEG	10K	3-13	1.5-7	470
300X	1MEG	3300Ω	3-13	1.5/	760
1000X	1MEG	1000	3-13	1.5-7	2200

Fig. 23-40B. Vertical amplifier of LfE Model 411. *Courtesy Laboratory for Electronics, Inc.*

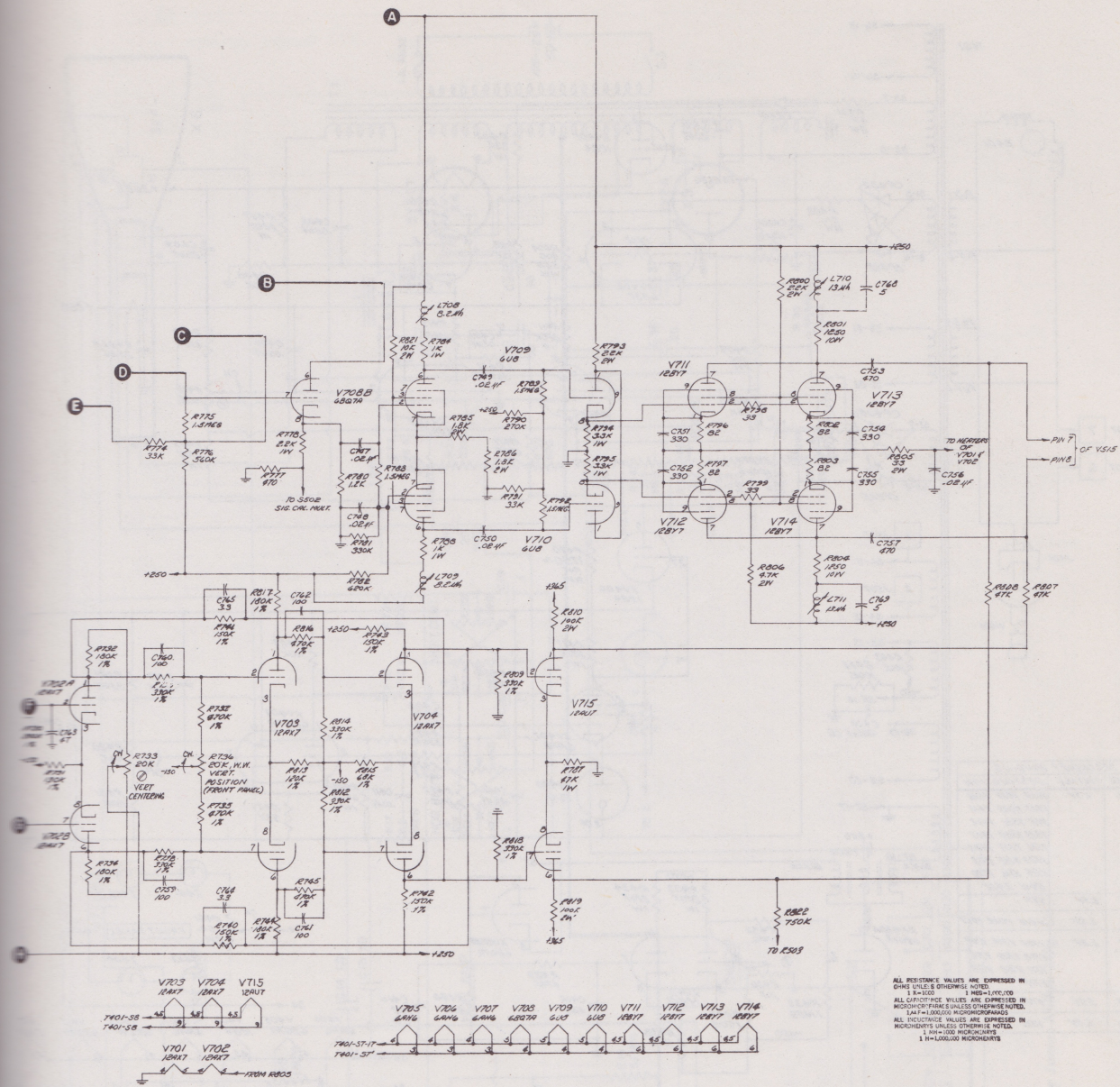
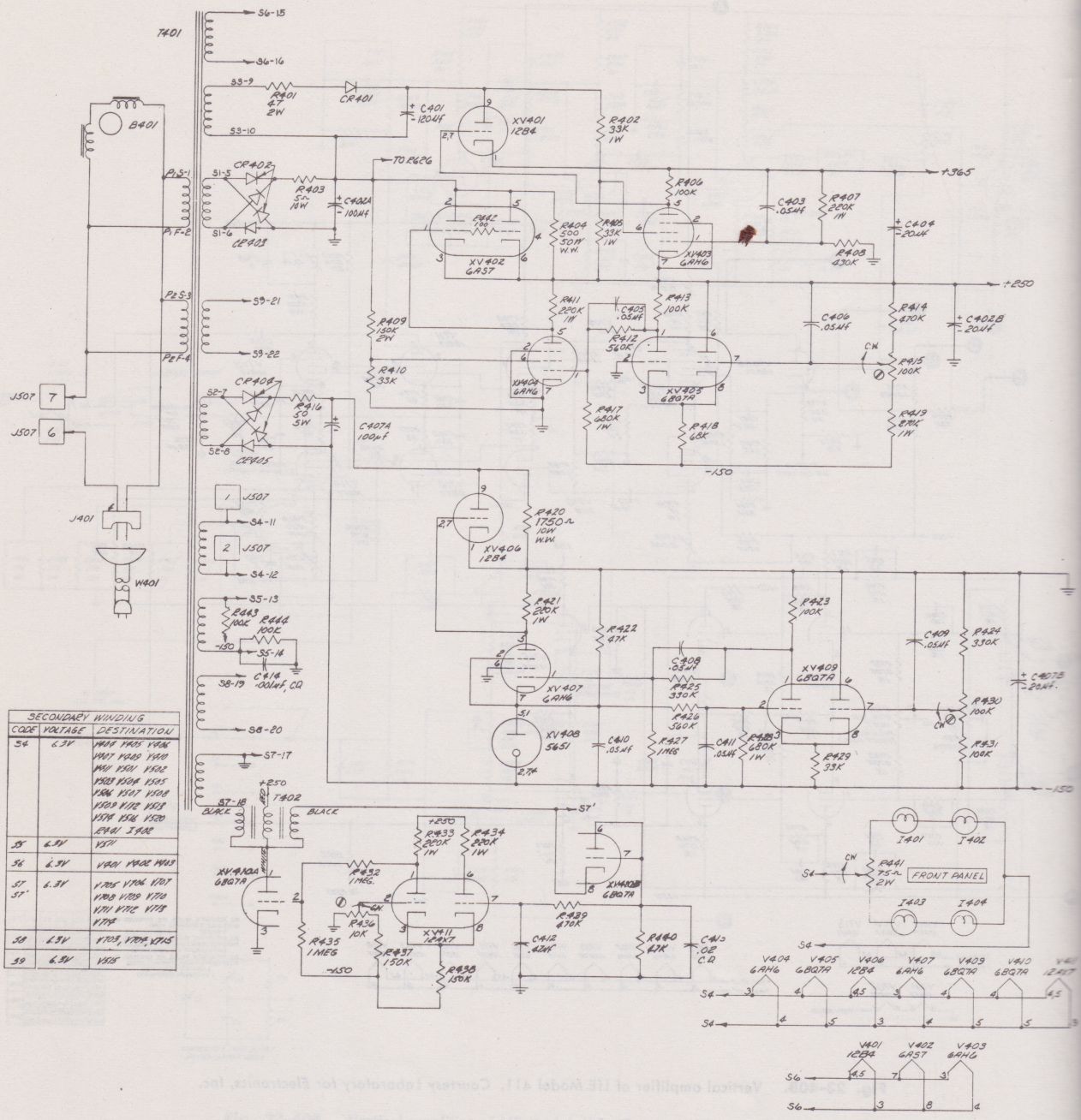


Fig. 23-40B. Vertical amplifier of LfE Model 411. *Courtesy Laboratory for Electronics, Inc.*



SECONDARY WINDING		
CODE	VOLTAGE	DESTINATION
S4	6.3V	V402 V405 V406 V407 V408 V410 V411 V501 V502 V503 V504 V505 V506 V507 V508 V509 V512 V513 V514 V516 V520 CR401 J402
S5	6.3V	V511
S6	6.3V	V401 V402 V403
S7, S7'	6.3V	V404 V409 V412 V413 V418 V419 V420 V421 V422 V423 V424 V425 V426 V427
S8	6.3V	V503, V504, V515
S9	6.3V	V505

Fig. 23-40C. Power supply of LfE Model 411. *Courtesy Laboratory for Electronics, Inc.*